OSU Scientists Use GPS to Chart Buildup of Galapagos Volcano

by Bend Weekly News Sources

The October 2005 eruption of Sierra Negra volcano in the Galapagos Islands was preceded by an extraordinary 5-meter uplift of the caldera floor in just a dozen years â€“ the largest inflation scientists have recorded prior to the eruption of a basaltic volcano.

The uplift was caused by magma accumulating beneath the volcano prior to the eruption, researchers say, and these kinds of measurable precursors can be used to forecast eruptions. This was the first time scientists had monitored the buildup to an eruption of a volcano in the remote Galapagos and they describe their findings in the December 2006 issue of Geology.

William Chadwick, a geologist at Oregon State University and lead author of the study, says the research is significant because it reveals clear interactions between inflation, faulting and eruption for the first time.

A ridge of the Sierra Negra volcano has been uplifted by repeated â€œtrapdoorâ€• faulting events. (Photo by Bill Chadwick)

â€œWe now have a much better idea of how the intrusion of magma makes space for itself in the shallow crust,â€• said Chadwick, a senior researcher at OSUâ€™s Hatfield Marine Science Center in Newport, Ore. â€œThe uplift was punctuated by a series of â€˜trapdoorâ€™ faulting events that relieved some of the strain caused by the intruding magma and effectively postponed the date of the eruption.â€•

â€œThis is what allowed such an unusual amount of uplift before it finally erupted and we were able to catch the volcano in the act,â€• he added.

Trapdoor faults are curved faults that bound blocks that are â€œhingedâ€• along one edge to their movement is like a trapdoor. At Sierra Negra, trapdoor faults in the caldera floor relieve pressure from below, like the edge of a lid on a boiling pot of water is lifted from the steam below, Chadwick said.

â€œThe trapdoor faults move in one-meter increments during large earthquakes, but over hundreds of years they have grown higher than the caldera rim at Sierra Negra, which is about 100 meters high.â€•

Sierra Negra is a large basaltic volcano with a caldera at the summit that is about nine kilometers across. The Galapagos volcanoes are similar to those in Hawaii and differ greatly from Mount St. Helens in Washington state, which is characterized by a different, more viscous lava composition.

This study was the first time that scientists had used global positioning system (GPS) technology at the Galapagos, Chadwick pointed out. GPS is a powerful new tool in the monitoring of volcanoes and earthquake faults because it allows scientists to measure movements of underground magma by measuring the displacement and deformation of the Earthâ€™s surface.

â€œThe technology is particularly helpful for monitoring the Galapagos,â€• Chadwick said. â€œThey are some of the most active volcanoes in the world, but among the least monitored because of their remote location.â€•

Chadwick said the researchers are not yet sure what triggered the 2005 eruption of Sierra Negra â€“ whether the volcano had â€œreached its limitâ€• of allowing magma to intrude into the crust, or if the pressure-release mechanism somehow broke down. In any case, he added, inflation at Sierra Negra resumed immediately after the 2005 eruption so the scientists expect more trapdoor faulting.

â€œOr we may see another eruption soon,â€• Chadwick said.

He and his colleagues say they hope that continued monitoring of Sierra Negra will help anticipate just what the volcano will do next, and why.

Other scientists involved in the Geology-published study include: Dennis Geist, the University of Idaho; Sigurjon Jonsson, the Institute of Geophysics in Switzerland; Michael Poland, the Hawaii Volcano Observatory; Daniel J. Johnson, the University of Puget Sound; and Charles Meertens, UNAVCO.